action. In other words, it was not biodegradable.

The surfactant then commonly used was a petroleum industry product, known to chemists as alkyl benzene sulphonate or ABS. In the early 1960's, to end the sudsing in our waterways, the industry produced a new surfactant—linear alkylate sulphonate or LAS. LAS decomposes readily under bacterial action, and has been used since 1966 in all detergents sold in Canada.

Detergents made with LAS are often labelled "biodegradable", but this can be misleading. Although the surfactant is biodegradable, the phosphate builder is not; and it is the phosphate which causes the problem. The builder commonly used is a sodium salt called sodium tripolyphosphate or STP.

Wanted: a substitute

To slow the process of eutrophication, we must either stop using detergents or drastically limit the amount of phosphate they contain. Restriction and eventual elimination of detergent phosphates are only the first steps in the gradual elimination of phosphates from all sources.

To maintain the cleaning effectiveness of detergents, the phosphates will have to be replaced by an equally effective but biodegradable substitute.

Considerable promise as a substitute has been shown by a by-product of the plastics industry, nitrilotriacetate or NTA. However, studies conducted at the U.S. National Institute of Environmental Health Sciences have cast some doubt on the advisability of using it to replace phosphates. When administered alone NTA had no effect on the health of laboratory animals, but embryonic malformations of types caused by heavy metals increased when NTA was given along with these metals.

Major detergent manufacturers in the United States stopped using NTA after being warned by the U.S. Surgeon-General that it might be harmful. But since 1968, one detergent manufacturer in Sweden has replaced 70 percent of the phosphates in some products with NTA without any reports of ill-effects and it is still being used on a small scale in Canada. Further work is being undertaken to determine whether NTA poses any hazard to health under normal use.

Phosphates and farming

The farmer needs phosphates, either in chemical fertilizers or in natural manure, to grow his crops. Once worked into the soil, phosphates are held there so securely that they will not easily wash out. The pollution hazard in agricultural operations usually comes from animal wastes and other organic matter carried off the land by melting snow. Sometimes, too, sizeable areas of fertilized topsoil are washed away not only by snowmelt in the spring but also during heavy storms. This process is known as erosion.

These and other causes of phosphate pollution can be controlled by good farming practices. For example, animal wastes should be used as fertilizer, applied in the regular way or with irrigation water. Erosion can be checked and runoff regulated by proper land use combined with conservation practices such as contour cultivation of hillsides, strip cropping and grassed runways.

It's up to everyone

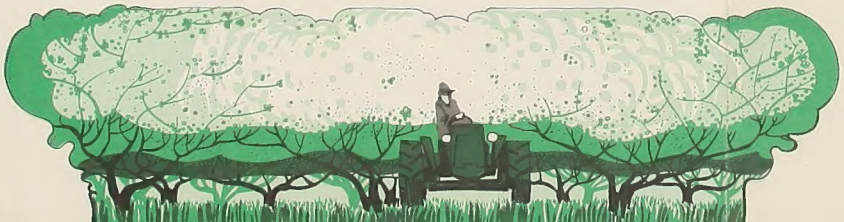
Checking phosphate input to our lakes and streams is not just a job for farmers, housewives, engineers and detergent manufacturers. It's up to everyone who uses phosphates or other phosphorous compounds in garden fertilizers, pesticides or other materials. It's up to everyone who maintains a house or cottage where no sewers exist for the disposal of wastes—where septic tanks or other facilities must be provided.

Where sewers do exist we must press for adequate sewage treatment, including the removal of phosphates. Since harmless substitutes for detergent phosphates may not be available in Canada in sufficient quantities for some time, we should, in the interests of protecting the quality of our water resources, be prepared to accept detergents that may be less effective. We should support legislation to control the use of phosphates— not only in soaps and detergents, but in other materials as well.

In brief, the control of nutrients—phosphates and nitrates—is a four-pronged effort—

1. A restriction, and later a ban, on the use of phosphates in detergents.
2. The construction of special waste treatment facilities to decrease the quantity of nutrients discharged from municipal sewage.
3. Minimizing, through improved farming practice, the amount of agricultural fertilizers washed from the land.
4. Minimizing sewage discharges in storm water overflows by constructing storm sewers separate from sanitary sewers.

The success of this effort depends upon public support. Whether we act as individual citizens or as members of an organized group, the responsibility is ours.



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why all the fuss about phosphates?

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Environment Canada | Environnement Canada
Water Management | Gestion des Eaux

L. Edgeworth, Assistant Deputy Minister

Water pollution begins at home—in the kitchen, the bathroom and the laundry. And among the most serious causes of pollution are the phosphates that go gurgling down our drains.

Phosphates are found in human and animal wastes, in commercial fertilizers and in many industrial wastes. We also find them in household detergents. Most of the detergents sold in Canada are used in the home, and detergent-rich sewage is a major source of phosphate pollution.

In themselves, phosphates are non-toxic. They are compounds of the element phosphorus, which is essential to life. Many of our soils are low in phosphorus and will produce good crops only if they are fertilized with phosphates. But in our waterways the phosphates act as fertilizer for weeds and algae, both of which are serious and growing nuisances.

Green for danger

Slimy green carpets of algae now threaten to stifle many of our lakes and other water bodies. They clog water intakes, produce unpleasant tastes and odors, foul our beaches and spoil our swimming and boating areas. Dead algae sink to the bottom and decay, using up dissolved oxygen needed by fish and other aquatic life.

With the water depleted of oxygen, desirable species of fish disappear. Their place is taken by coarser, less valuable species which need less oxygen. Meanwhile blood worms, sludge worms and other lowly organisms replace higher forms of life on the bottom.

In losing oxygen, moreover, water loses a natural purifying agent. Dissolved oxygen normally allows a lake or river to cleanse itself after receiving considerable quantities of oxidizable waste. By using up this oxygen, decaying algae aggravate other pollution problems.

Phosphates and nitrates

The excessive fertilization of our waterways, producing an overgrowth of algae, is known as eutrophication. Many factors are involved in the eutrophication process, such as availability of carbon dioxide for photosynthesis, abundant sunlight, high temperatures and clarity of water for light penetration. However, the phosphate nutrient factor is considered to be one of the most critical.

Phosphates and nitrates (the latter also includes plant nutrients) are both discharged into our lakes and streams through municipal sewage outlets. Because they are used widely in farm fertilizers, some may also enter directly from the land. When phosphates are worked into the top few inches of soil, they become fixed and will not, except in cases of severe soil erosion, find their way in significant quantities into lakes and streams. However, if large quantities of nitrates are applied, some may leach down to the water table.

The atmosphere is another source of nitrates and other nitrogen compounds. These fall with the rain so it is virtually impossible to control additions from this source.

To slow the process of eutrophication, the obvious course is to reduce the volume of phosphates being discharged into our waterways. This can best be done by carefully controlling and restricting the use of phosphates, particularly in detergents, and by removing the phosphates by special processes in sewage treatment plants. Neither course of action by itself is enough. We must use both methods of attack.

Phosphate removal

Ordinary sewage treatment is designed essentially to remove organic wastes, which often harbour dangerous disease organisms. It is not designed to remove phosphates, which in themselves are no health hazards. Effective phosphate removal requires special treatment facilities.

The technology of phosphate removal from municipal sewage is under development. Action is being taken by pollution-control agencies of government to move forward from the pilot plant scale of testing to full-scale operational plants.

Modifications to existing plants will take time and their cost will be high. However, in the long run it will be far less than the value of the resources they threaten.

How detergents work

In the 1940's, scientists found that combining synthetic soap with a special type of phosphate yielded a washing product far more effective than the earlier synthetic or organic soaps. This discovery led to the development of the phosphate-based detergents which ushered in a bright new age of washday miracles. The advertisements were right: the new detergents got clothes cleaner and whiter than ordinary soap, and worked effectively even in hard water.

Detergents now contain a number of chemicals that do specific jobs—like whitening clothes, protecting washing machines against corrosion, stabilizing suds in top-loading machines and suppressing them in tumbler machines. Some detergents also contain enzymes to break down the proteins in blood, chocolate and other stains. But their main components are the surfactant (surface-active agent) and the builder—usually a phosphate.

The surfactant is the suds-producing ingredient, a superior replacement for soap. Like soap, it increases the wetting action of water by lowering its surface tension. It emulsifies oily substances and holds them in suspension in the water, after prying them loose from fabrics or other materials. Unlike soap, however, it does not precipitate mineral salts to form a curd-like scum.

The phosphate builder softens the wash water, enabling the surfactant to work more effectively. It also makes the water more alkaline, thereby aiding the removal of grease and oil. At the same time, phosphate helps remove soil and other fine particles from cloth fibres. Most important, though, it powerfully reinforces the action of the surfactant, as a loudspeaker amplifies a voice.

What went wrong?

People first became disturbed about detergents when billowing masses of suds appeared in our rivers, lakes and sewage disposal plants. This happened because the surfactant—the sudsing ingredient—would not break down under sewage treatment or other bacterial